A Business Goal-Based Approach to Achieving Systems/Software Engineering Capability Maturity

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Multi-Dimensional Maturity

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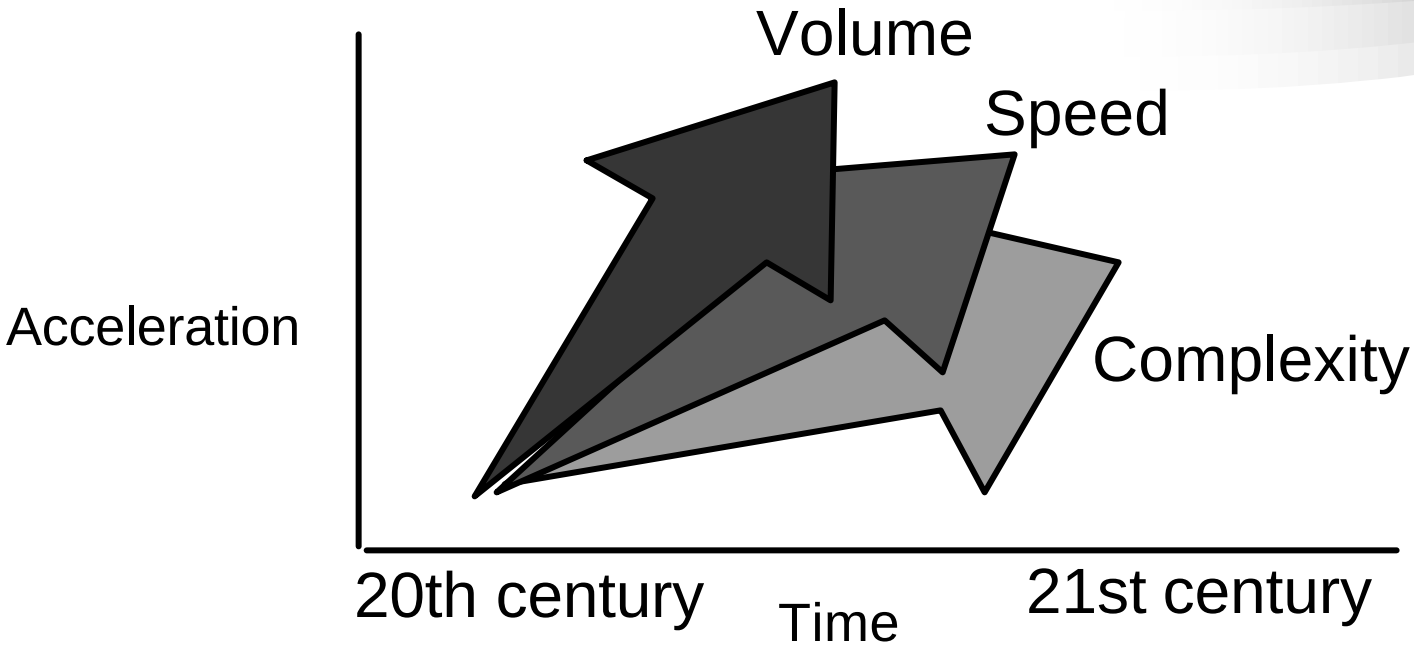
Agenda

- MOTIVE - Why change?
- MODEL – Which model?
- METHOD – How to assess?
- MANAGING CHANGE – How to implement improvements?
- MEASURES – How to measure progress?

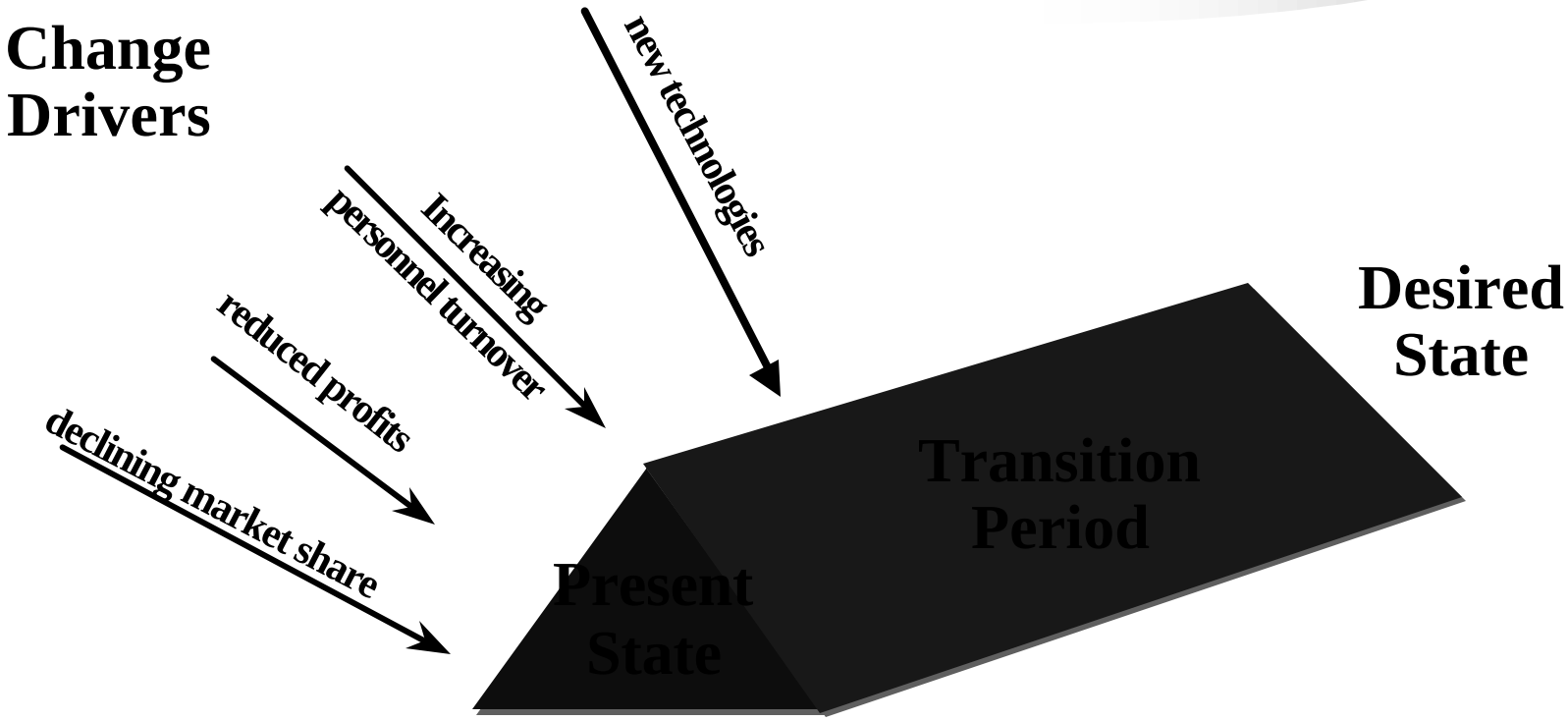
Need for Change



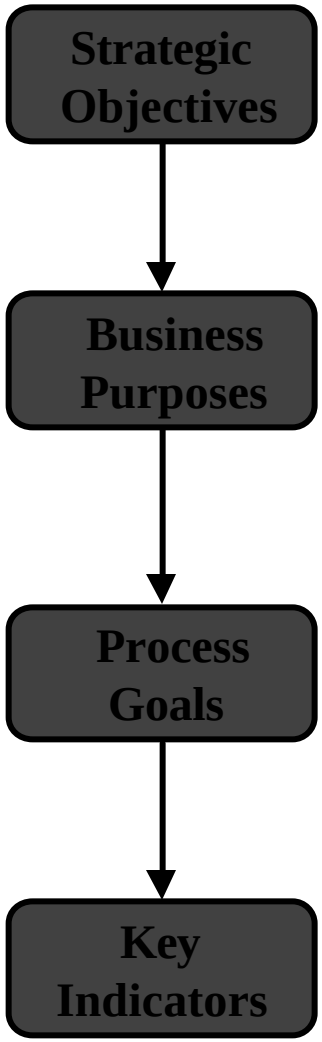
"We must learn - individually and as organizations - to welcome change and innovation as vigorously as we have fought it in the past . . .The corporate capacity for change must be dramatically increased."

Tom Peters: Thriving on Chaos

Basic Change Model



Top Down



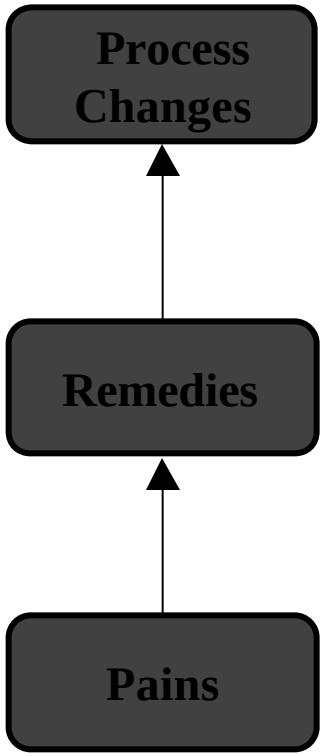
Business leaders determine critical business drivers and associated strategic objectives

Department leaders identify business purposes and goals that support the strategic objectives

Technical and process leaders document process goals that support the business purposes (approved by business and department leaders)

Technical and process leaders determine key indicators that measure progress against goals (approved by other leaders)

Bottom Up



Process owners identify related process changes

Leaders and users brainstorm possible remedies to address the pains

Technical and process leaders meet with process users to identify significant problems

Case Study

- Small industry-leading company with hardware product and embedded software
- Software is “free” with the hardware purchase
- Largest customers carry the most weight
- ☹ Market drives the schedule; customers demand software changes fast
- ☹ High incidence of software defects

Motive:

Top-down - strategic objectives are to reduce cycle time and increase quality

Bottom-up - pain is excessive defects causing rework

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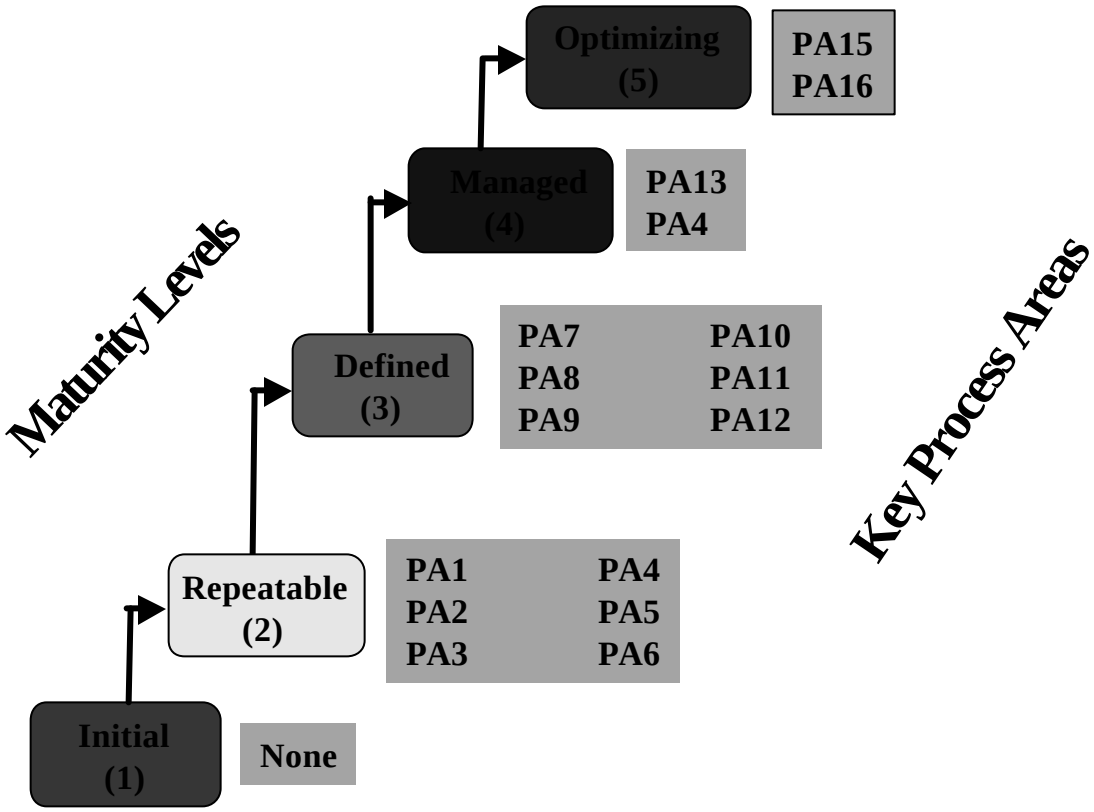
Domain of a Model

- The system whose order and effectiveness are to be improved: e.g.,
  - CMMI
    - Software CMM
    - System Engineering CMM
  - People CMM
  - System Acquisition CMM

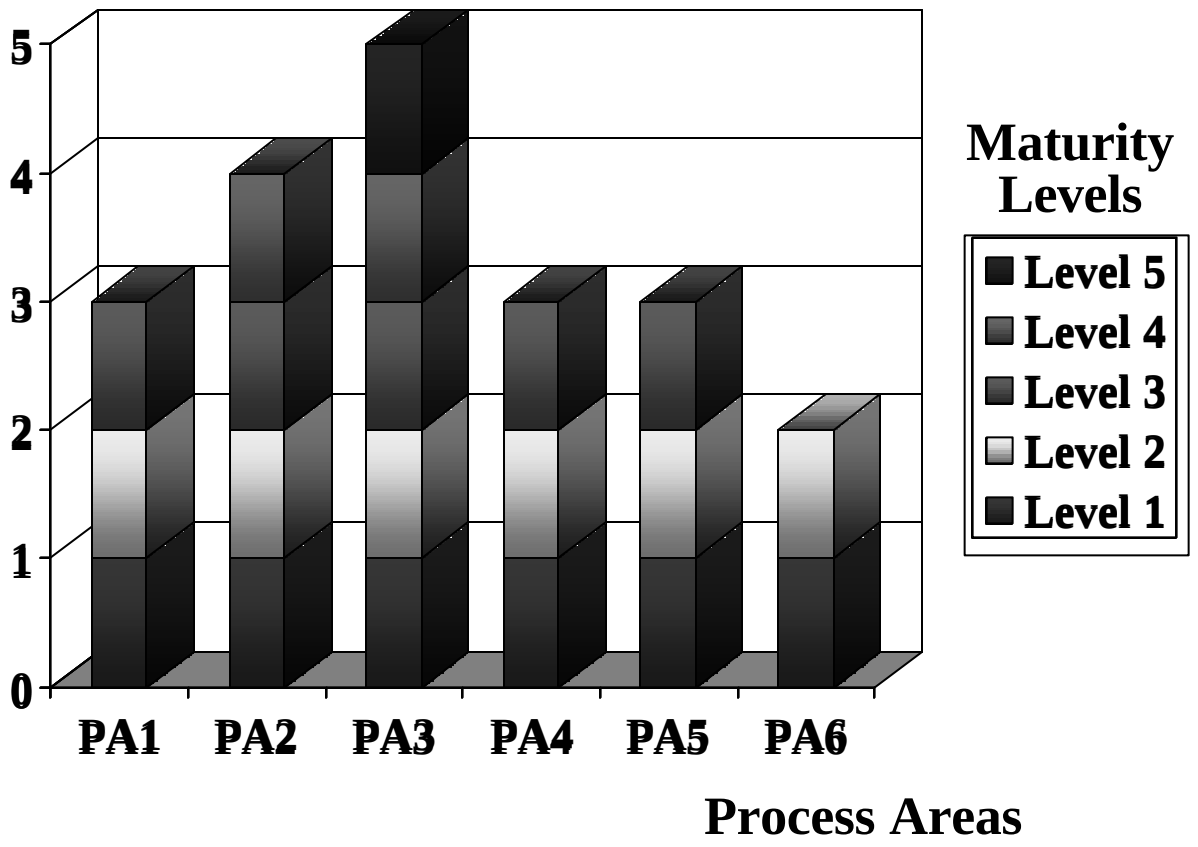
Model Architecture: Staged

- Maturity levels have KPAs
- Provides clear road map for improvement



Model Architecture: Continuous

- Process Areas have maturity levels
- Provides broad picture of processes



Choosing a Model

- Which model and architecture best map to your objectives?
  - What's the domain of interest?
  - Need a roadmap for improvement?
    - **Staged**
  - Want a picture across all processes?
    - **Continuous**
  - Focus on a few processes?
    - **Continuous or staged**

Case Study - Model

- Reduce cycle time:
  - Understand/control requirements
  - Use planning templates
  - Minimize rework
- Reduce defects
  - Peer reviews/testing

Note that the focus is not on a Level, but on technical aspects of certain PAs.

CMMI:
- *RM*
- *PP/PMC*
- *PPQA*
- *CM*
- *Inspections*
- *Test*

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Assess Organization

Mentored Self Asse

Interim Profil

Mini-assessm

Assessment Considerations

- Accuracy
- Cost
  - Assessment preparation
    - Organization preparation
    - Team training and preparation
  - Assessment conduct
- Organization Disruption

  (any measurement impacts object being measured - this is a basic law of physics)

Comparison

Type	Accuracy	Cost	Disruption
Self	Low	Low	Low
MSA	Fair	Low	Low
IntProf℠	Fair	Low	Low
Mini	Moderate	Moderate	Moderate
CBA-IPI	High	High	High
SCE℠	High	High	High

**** Values are the author's estimates of accuracy, cost and disruption.***

Case Study- Assessment

- A CBA-IPI, while having the greatest accuracy and organizational impact, would be fairly expensive.
- A mini-assessment could be used to provide a “quick-look” to identify greatest weaknesses quickly and relatively inexpensively.
- A mentored self assessment was chosen as providing a reasonable amount of information at a low cost.

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Lasting Change

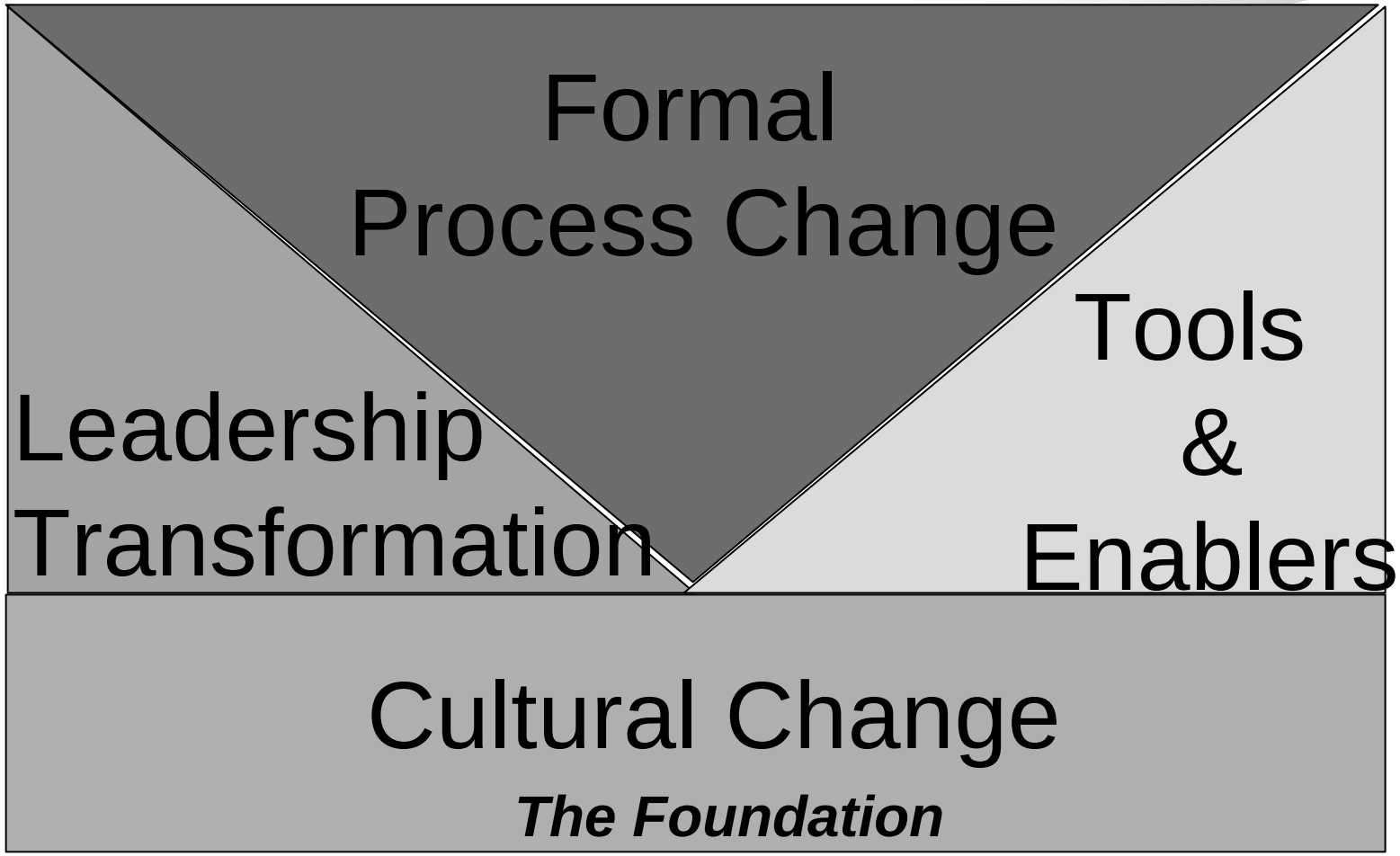
Process improvement requires people in the organization to change their behaviors, and that requires attention to a whole range of organizational and cultural issues.

Process and Culture

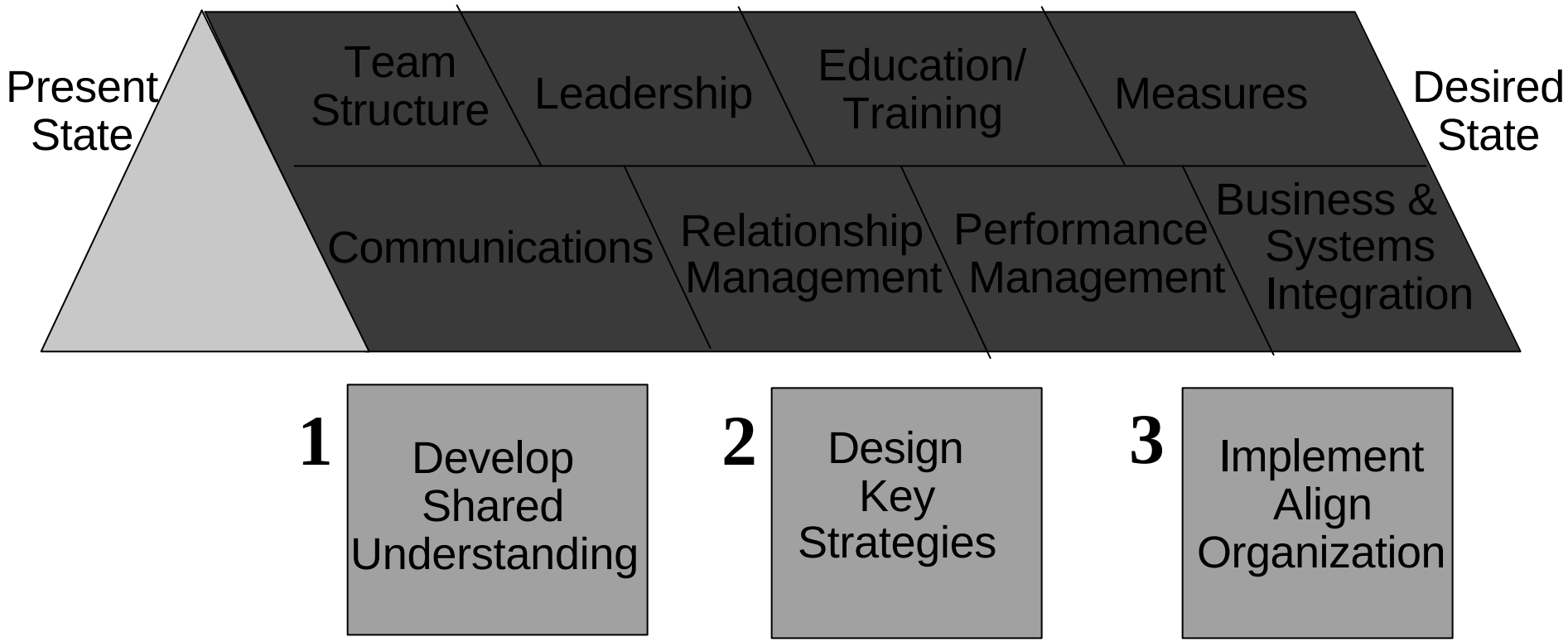
- Major changes to the software process must start at the top.
- Ultimately, everyone must be involved.
- Effective change requires a goal and knowledge of the current process.
- Change is continuous.
- Software process changes will not be retained without conscious effort and periodic reinforcement.
- Software process improvement requires investment.

Watts Humphrey: Managing the Software Process

Process vs. Culture



Transition Strategies



Case Study - Changes

Determine the transition strategies that will be most effective in implementing new processes:

- Organizational Structure:
  - Create a combined SEPG/SQA group
  - Train them, use their leveraged resources to:
    - define process changes
    - follow up on implementation
- Sponsorship:
  - Educate leaders first and get them on board, including the marketing team that drives Engineering Change Requests (ECRs)
  - Have leaders model the expected behaviors
  - Make sure leaders monitor team progress

Case Study - Changes

More Transition Strategies:

- Education/Training:
  - Use Process Action Teams to develop training
  - Establish subject matter expert networks to coach and mentor on new/revised processes
- Communications:
  - Establish process improvement bulletin board and monthly newsletter
  - Post organizational policies and distribute color copy to everyone
- Business/Technology Process Integration
  - Post process goals along with business goals
  - Integrate software engineering processes with Engineering Change Request process

Case Study - Changes

More Transition Strategies:

- Performance Management:
  - Add objective process improvement goals to leader incentives
  - Include software engineering process knowledge and skills in performance reviews
  - Start providing bonuses for “fire prevention”, avoiding weekend fixes
- Relationship Management:
  - Share process improvement plans with marketing and long-time key customers
- Measures:
  - Determine baselines for turnaround time
  - Break down the process and measure the parts
  - Establish objective process measurement goals

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Evaluate Impact

The final step* in process improvement is to determine the impact on the organization of the changes which have been implemented. This implies some set of measures which can be compared against a baseline in order to determine quantitatively how successful the process improvement program has been.

*(and the first step in the next cycle)

Two Uses of Metrics

- Informational
  - process/product insight, decision-making
  - should not affect behavior
- Motivational
  - provoke greater effort in pursuit of organizational goals
  - should affect behavior
- Mixing the two purposes can have negative effects (esp. transforming informational measures into motivational)

Measurement Problems

- "Nearly 80% of software measurement programs fail within the first two years."

  Goodman, "Practical Implementation of Software Metrics"

- Two problem areas:
  - Meaning: technical problems
  - Motivation: psychological problems

Technical Problems

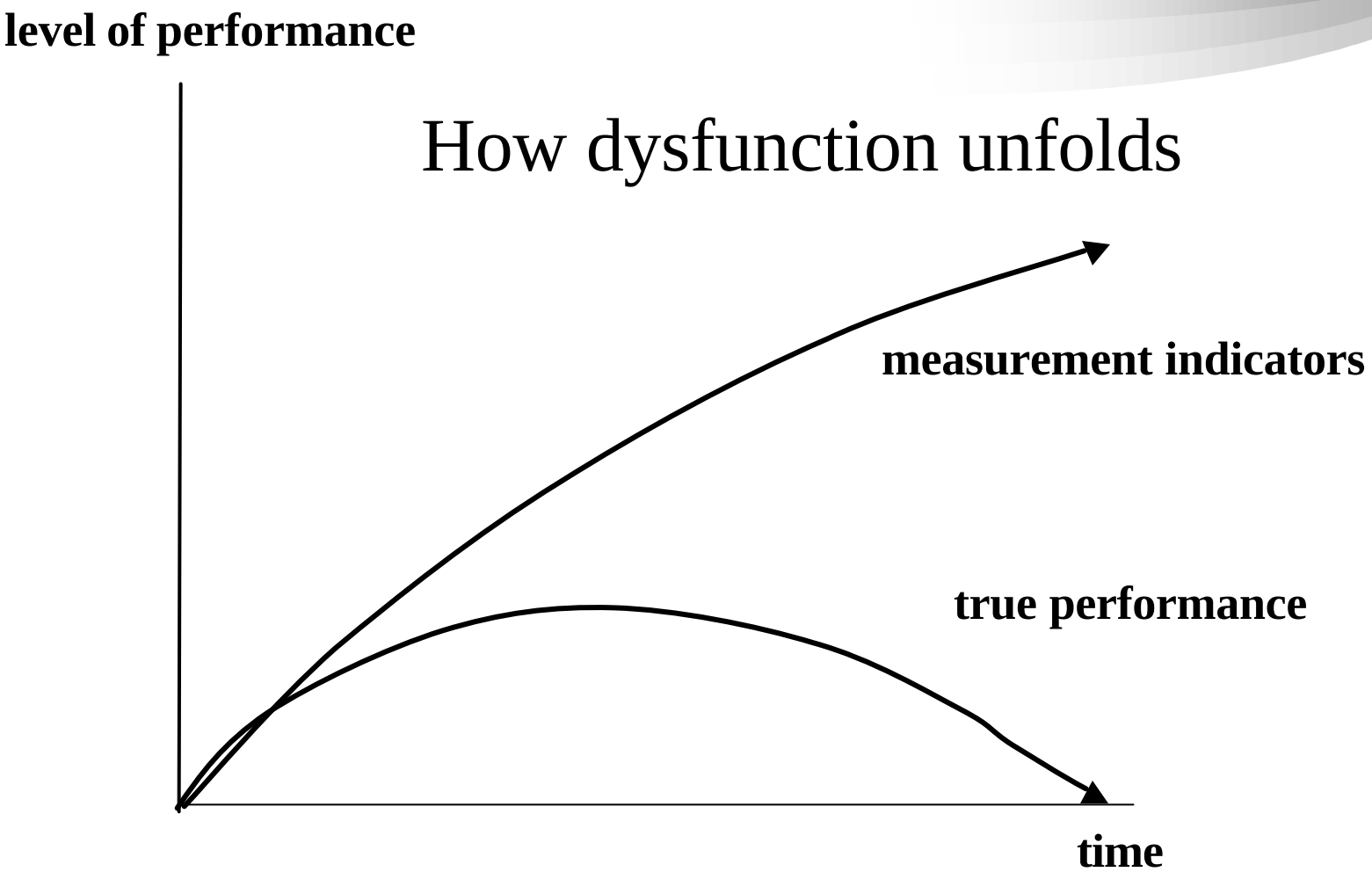
- Unclear meaning: numbers may not be clearly understood, due to not realizing the implicit model between the numbers and the reality.
  - ***e.g., what is the meaning in the real world of the Technical Complexity Factor in the Function Point Method? How does this impact project effort?***
- Inappropriate operations: not all numbers can be meaningfully averaged or otherwise combined or manipulated.
  - ***e.g., saying a 2000 LOC program is twice as big as a 1000 LOC program may not be a meaningful statement.***

Psychological Problems

- "Dysfunction occurs when the validity of information … is compromised by the unintended reactions of those being measured."
- "The major problem for most incentive systems is … bias intentionally introduced by those being measured."

Austin, "Measuring and Managing Performance in Organizations"

Dysfunctional Measures

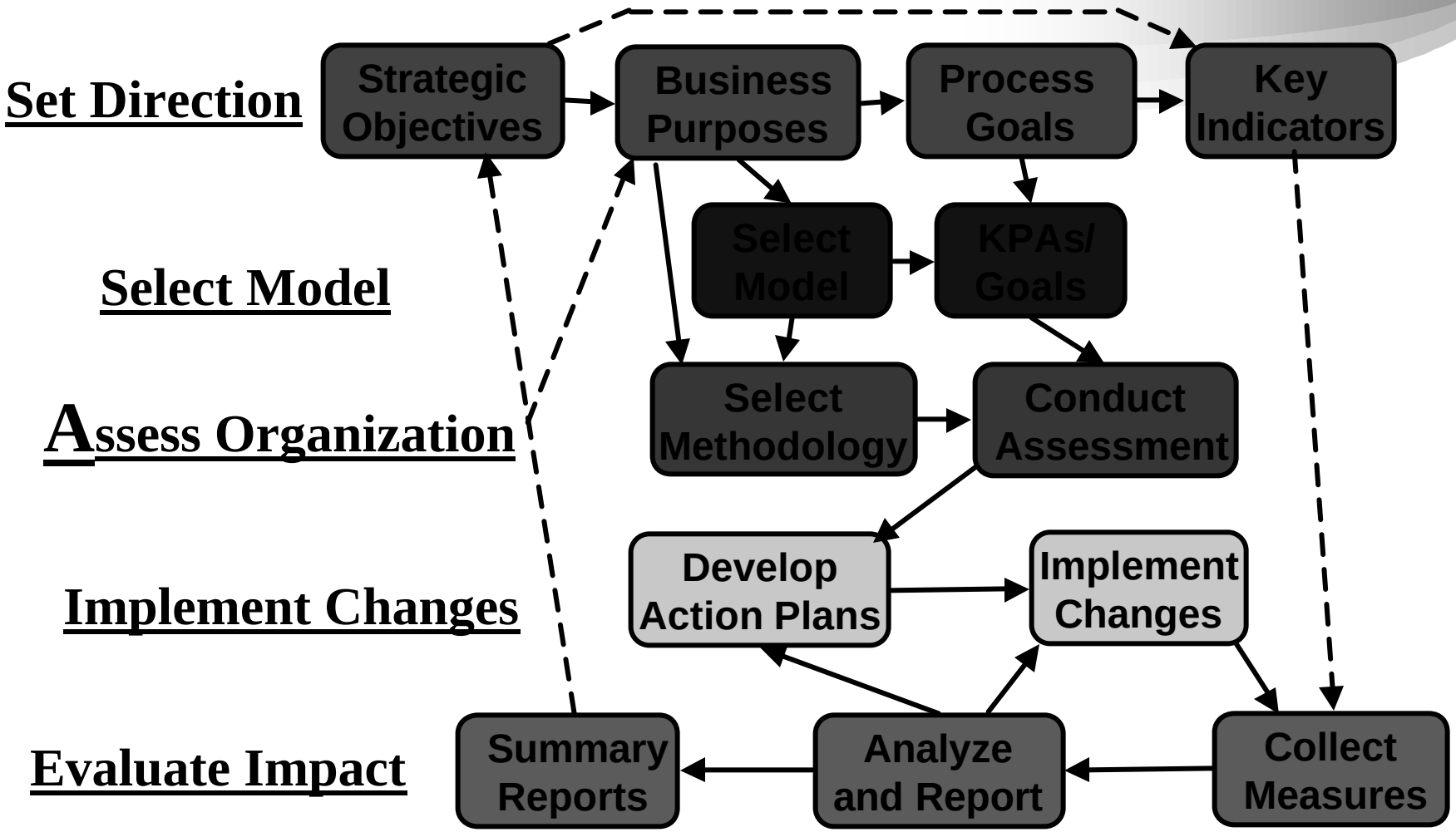


Austin, "Measuring and Managing Performance in Organizations"

Case Study - Measures

- Use the two key indicators
  - *Request-to-delivery time*
  - *Field failures due to software*
- Use supplemental metrics
  - *Requirements change rate*
  - *Number of off-release insertions necessary*
  - *Defects in code, engineering test*
  - *Customer fulfillment*
  - *Personnel turnover*

Purpose Driven Process Improvement℠ Framework



Purpose Driven Process Improvement is a
Service Mark of Multi-Dimensional Maturity

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